

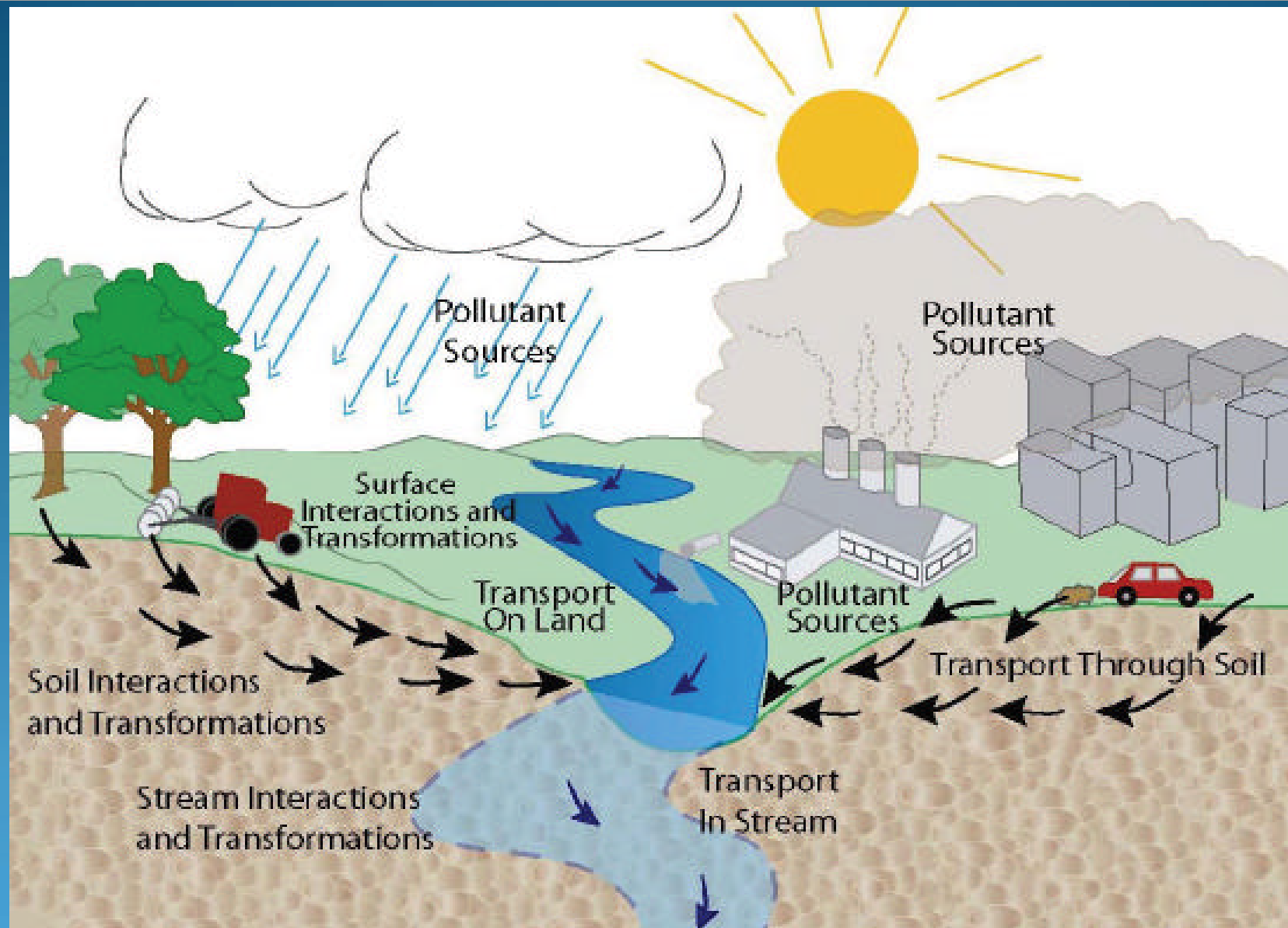
# James River PCB TMDL Study: Numerical Modeling Approach

Jian Shen

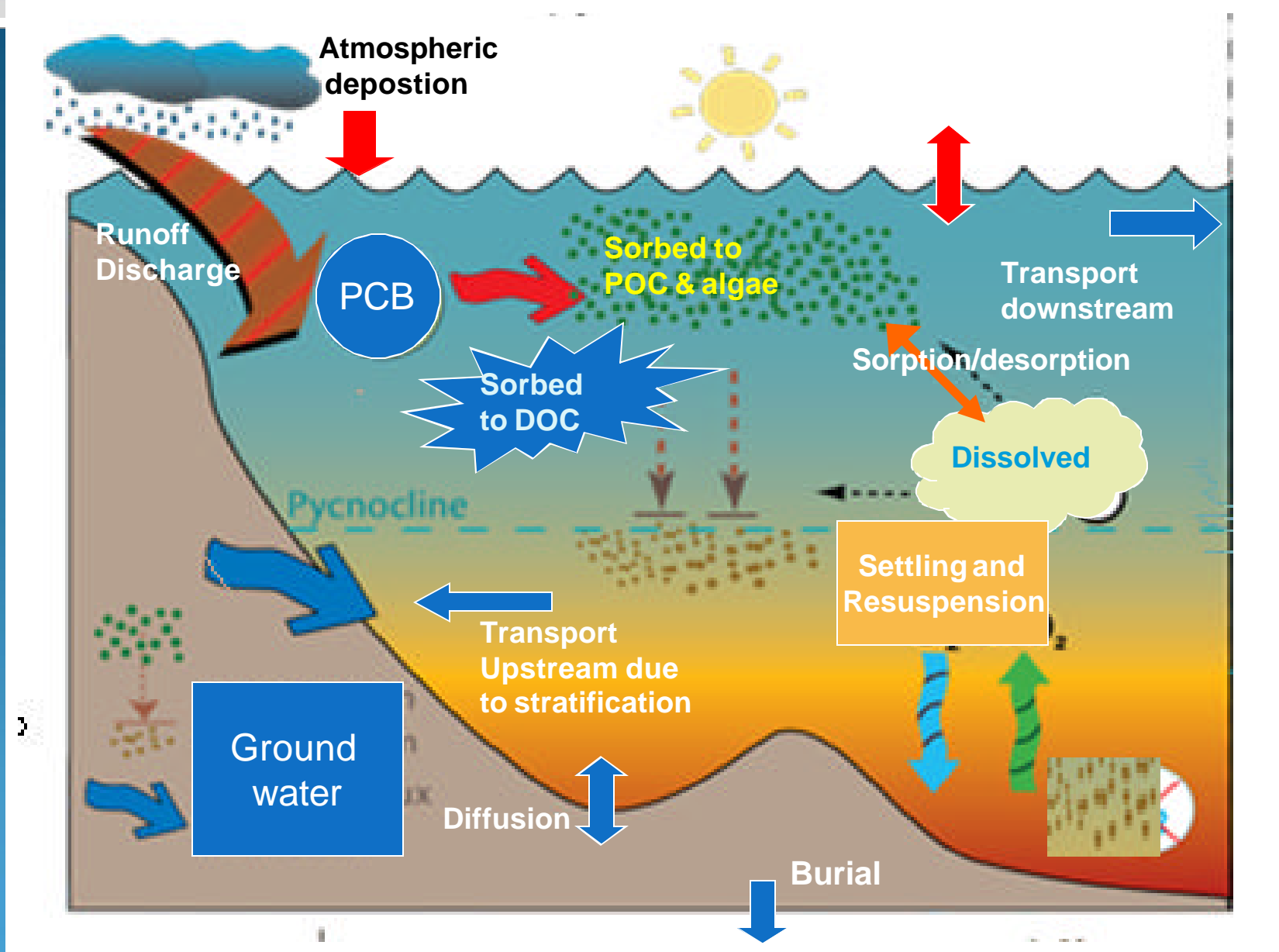
Virginia Institute of Marine Science  
College of William & Mary



# Pollutant Sources from Watershed



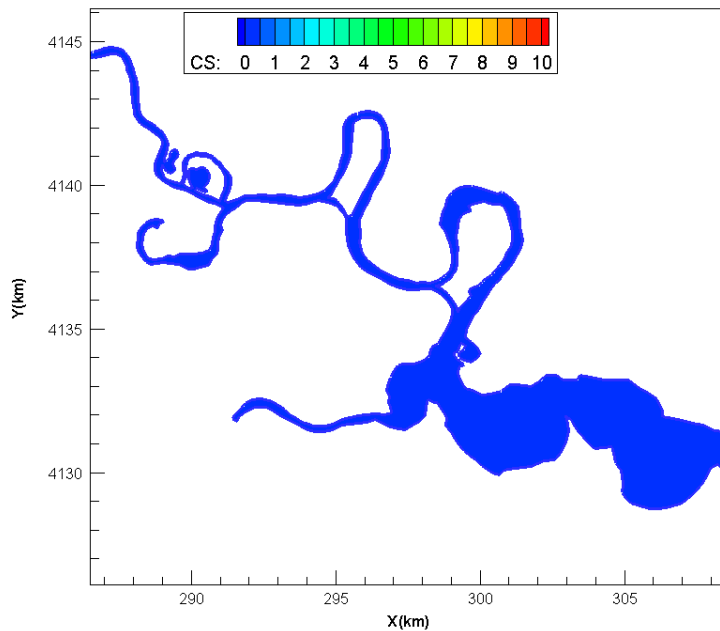
# PCB Transport in Estuary



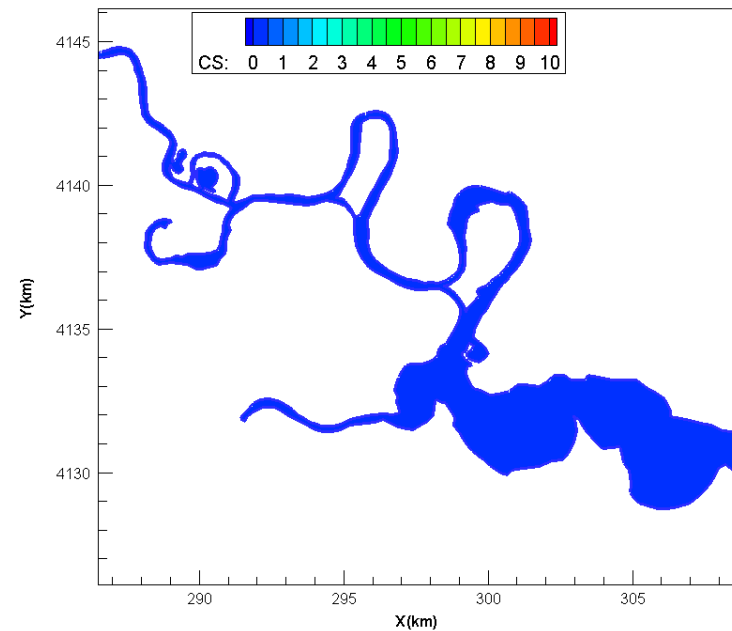
# Pollutant Transport in Estuary

## Upper James River

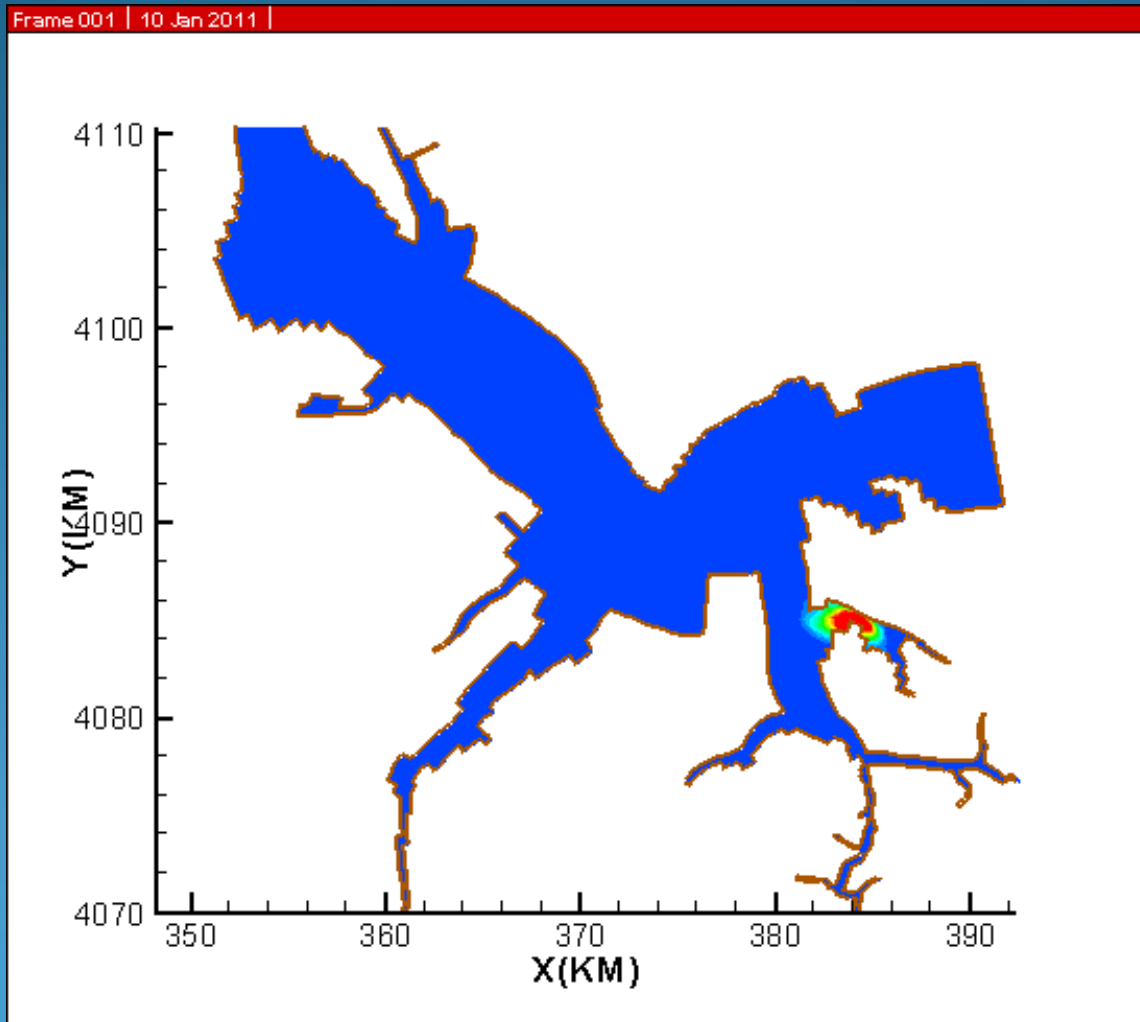
JAM99 (Low flow), VIMS | 24 Dec 2007



JAM75 (Low flow), VIMS | 24 Dec 2007

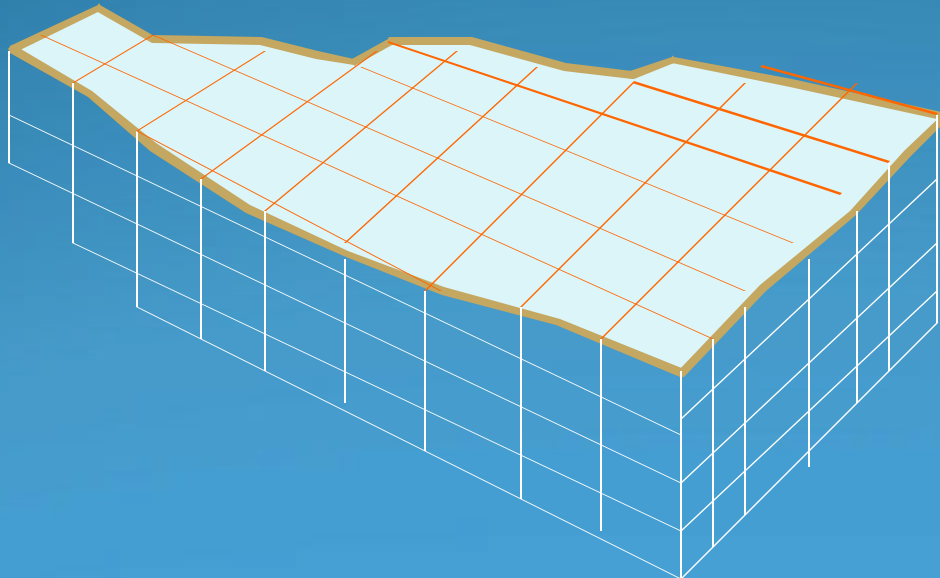


## Lower James River

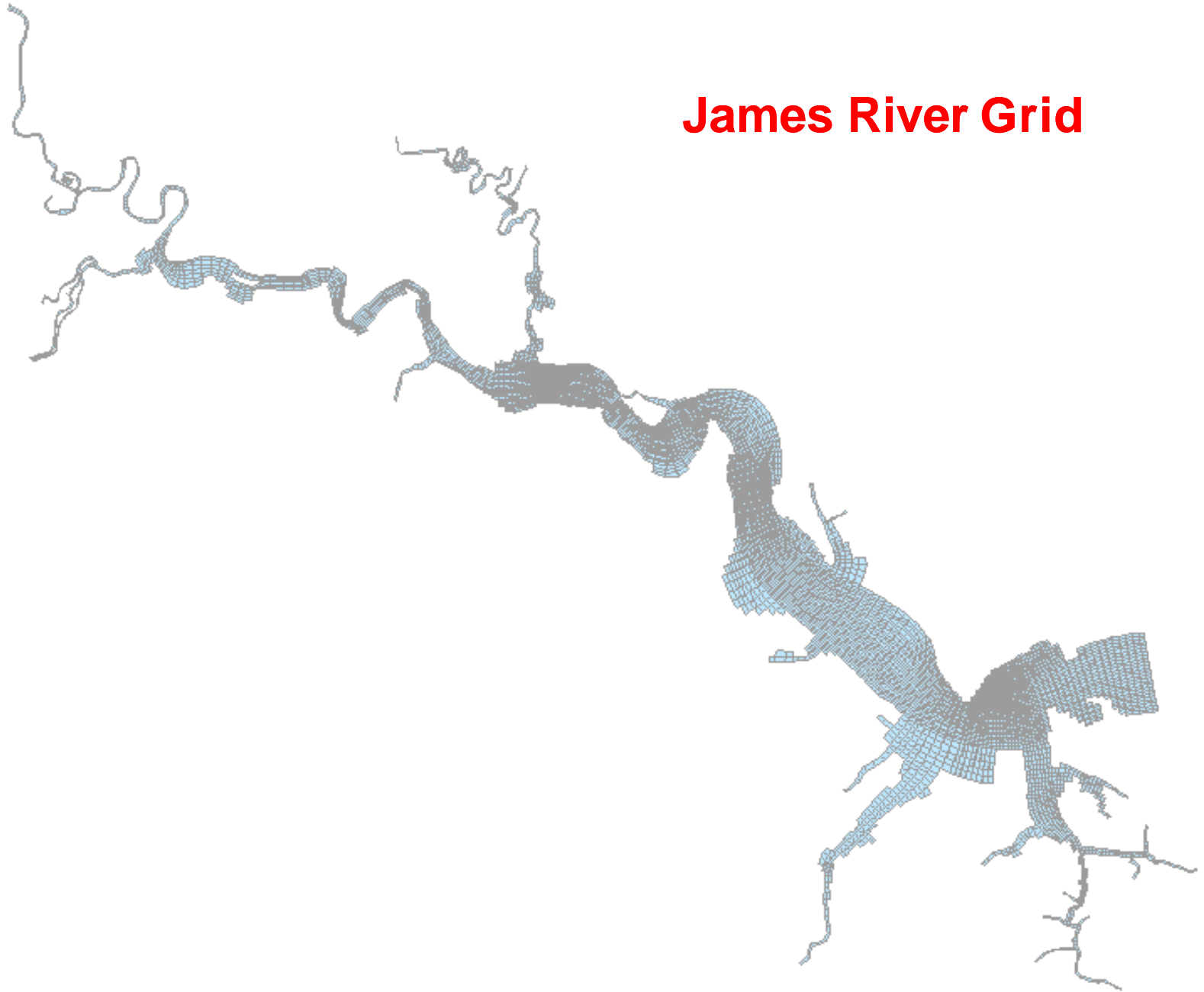


# Modeling PCB concentrations in an Estuary

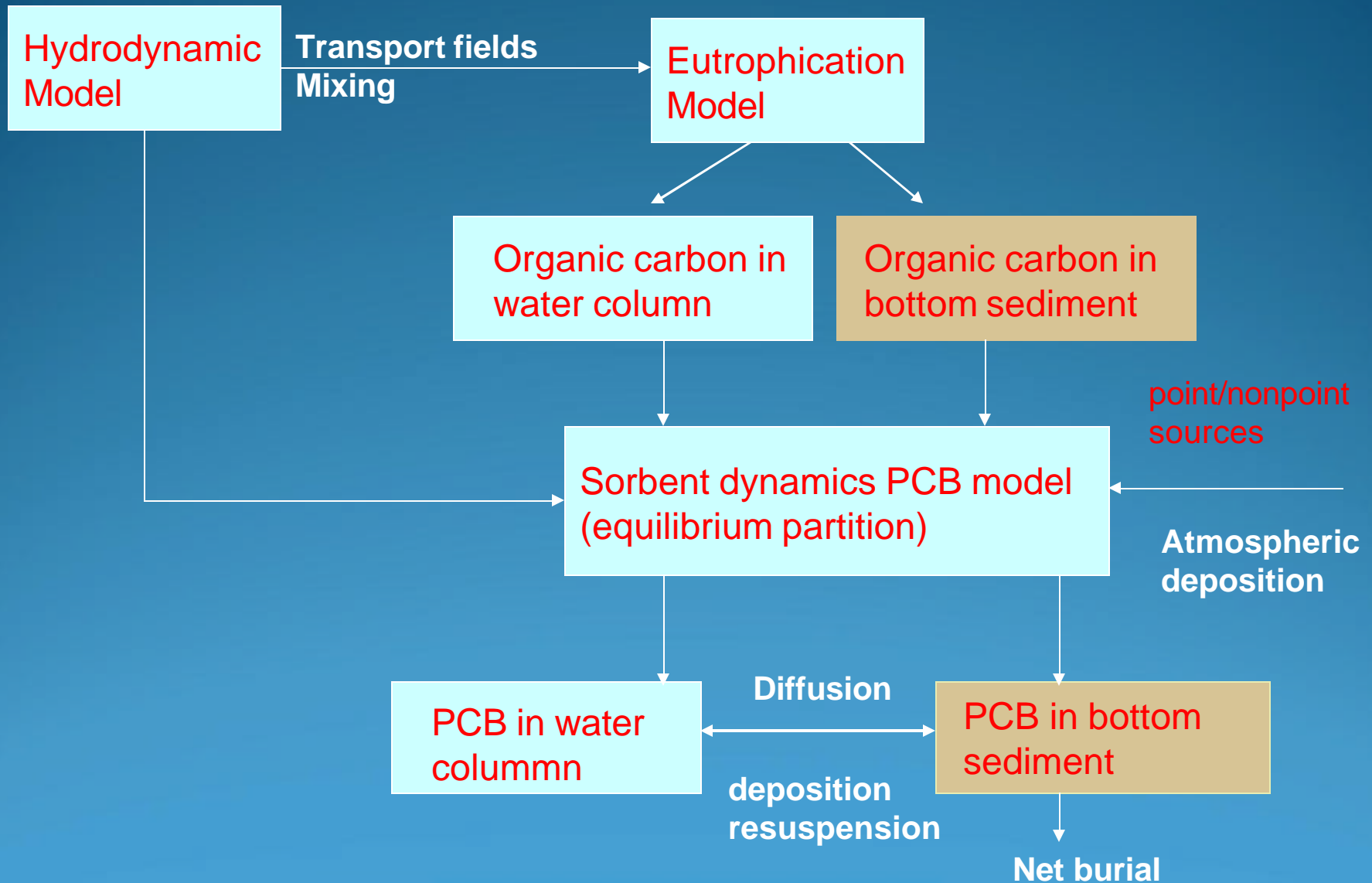
- Use Environmental computer model to simulate PCB transport in the estuary
- Environmental computer models are mathematical representations of real-world conditions and are used to estimate environmental events and future changes.



## James River Grid



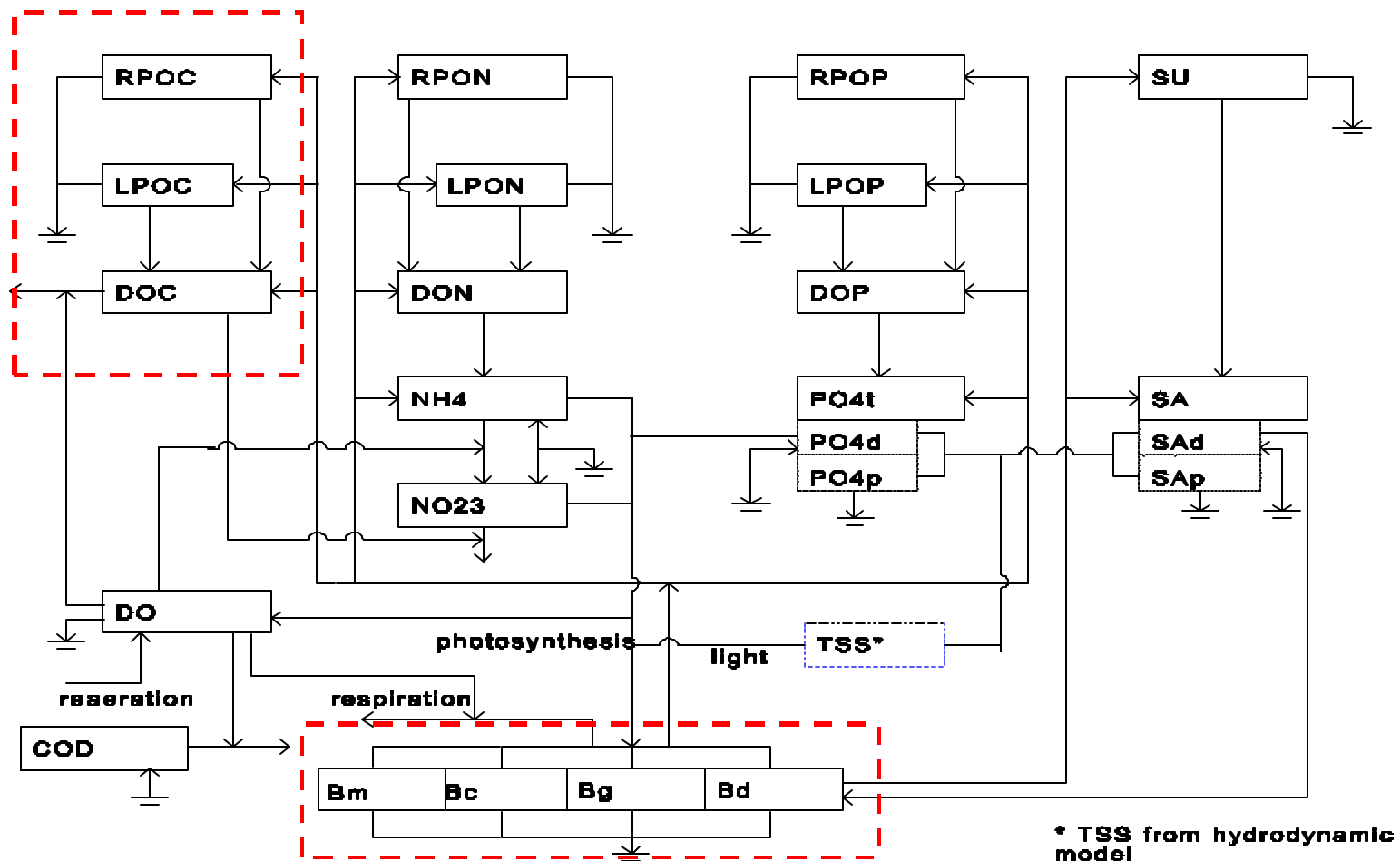
# Modeling Framework



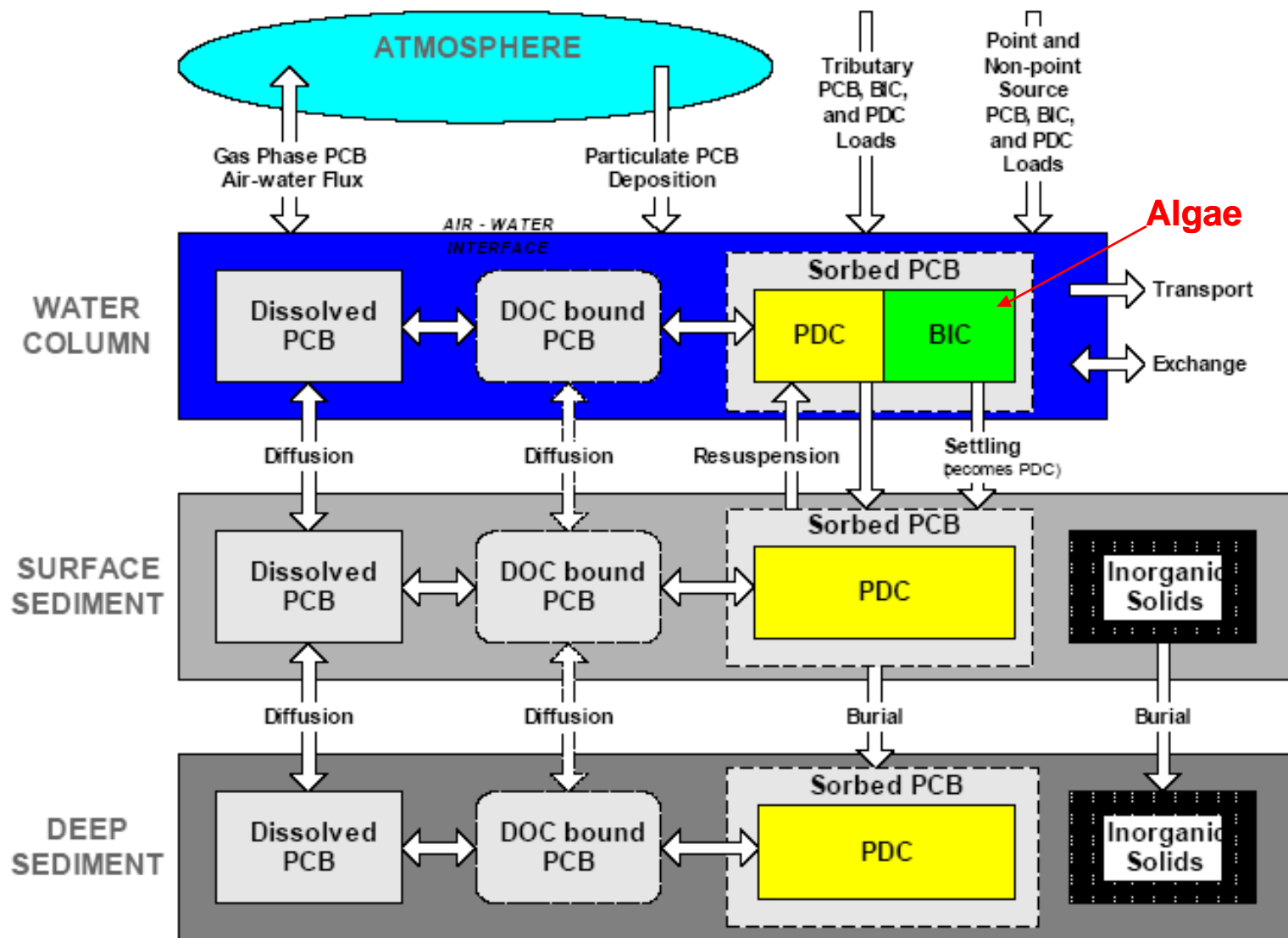


# Organic Carbon

- Use eutrophication model to simulate organic carbon



# PCB Model

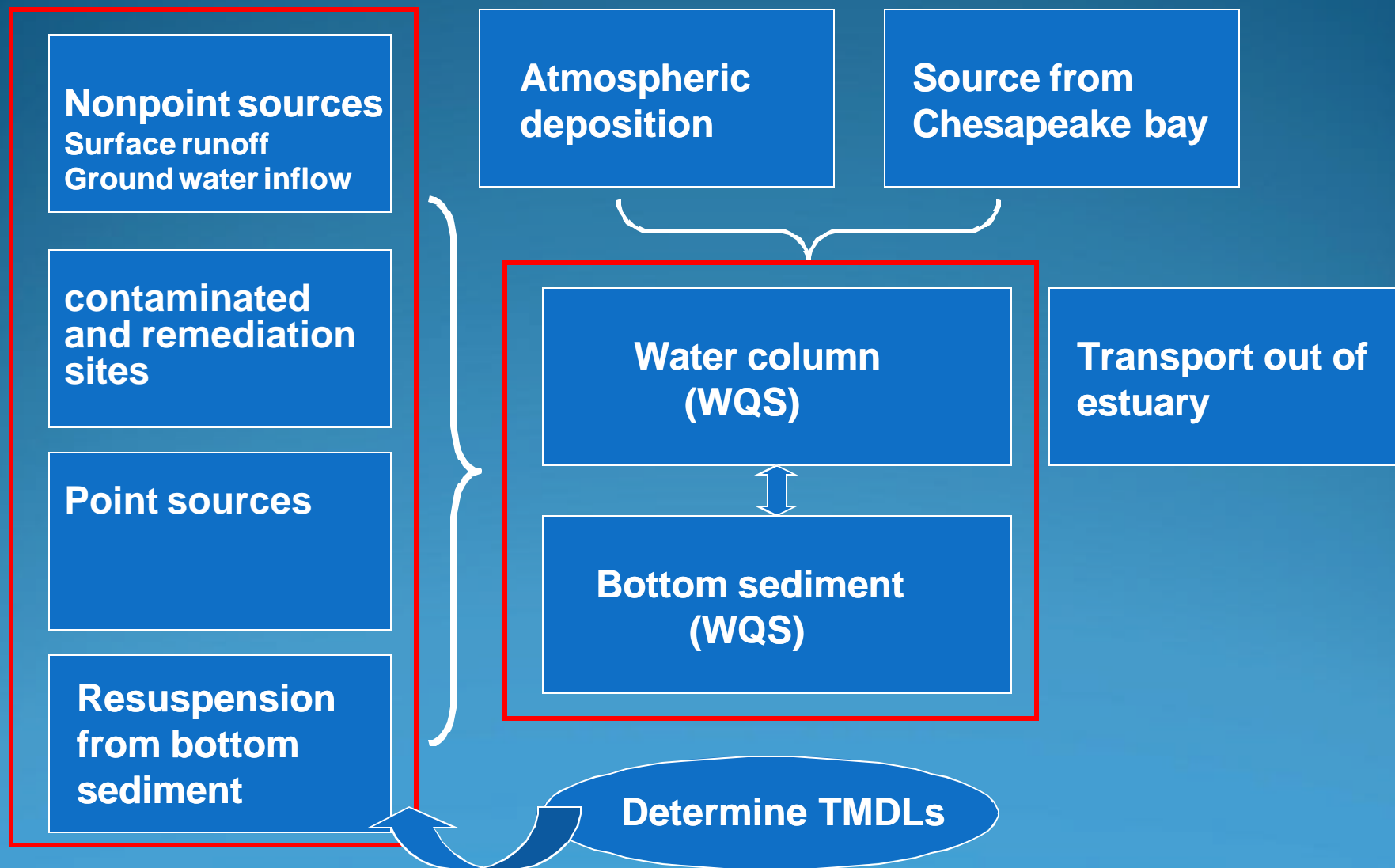


(Courtesy of LimnoTech, EPA2007)

# Loading Estimation

- Identify contaminated and remediation sites
  - Estimate loadings from contaminated sites
- Estimate point source discharges
  - Point source discharge from permitted facilities
  - Storm water discharge
- Estimate atmospheric deposition
- Use event mean concentration method
  - Loads are derived from high and low flow measurements
- Estimate unknown sources
- Use other methods
  - Inverse method
  - Modified acceptable results (i.e., TSS and modified by measurements)
  - Use watershed model to simulate PCB loadings

# PCB Budget and TMDL



# Summary of Modeling Approach

- Entire James River will be simulated
- Model grids will be refined locally to meet the need for TMDL development
- Different methods will be evaluated based on available data to estimate PCB loadings
- PCB transport between atmospherics, bottom sediment and water column, and between James River and Chesapeake Bay will be simulated
- Eutrophication sub-model will be used to simulate organic carbon
- An equilibrium sorbent dynamic PCB sub-model will be incorporated into the hydrodynamic model to simulate PCB transport in the estuary
- PCB sources, including atmospheric deposition, resuspension from the bottom sediment, runoff, ground water, and point sources etc., will be evaluated through data analysis and model simulations to determine their contribution to the impairment
- Model will be calibrated for carbon and PCB for selected years
- Long-term model simulations will be conducted to develop TMDLs



**Comments ?**

**Thanks!**

